

LArIAT (T-1034) Beamline Detectors ORC Documentation

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Experiment: T-1034 [TSW](#)

Location & Inspection Date: MC7, Wednesday, March 4, 2015

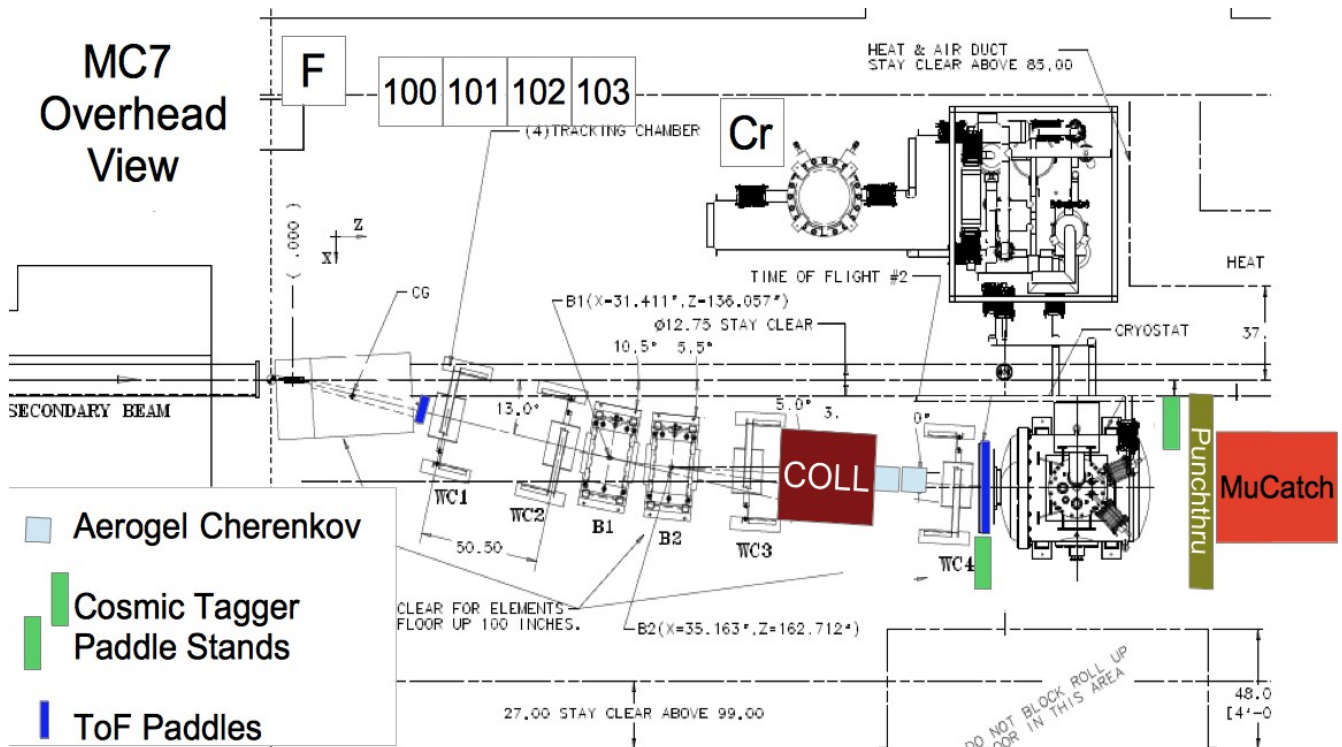
Brief Introduction

New: We are requesting an ORC for the aerogel Cherenkov, cosmic, and muon catcher systems which closely surround the cryostat. New equipment for the cryogenics, TPC readout, TPC drift and bias, and TPC optical detectors are present but incomplete. These incomplete systems will not be operated.

Prior: These components are joining the beamline chambers, counters, electronics racks, cabling, etc, which were checked out and approved 2014 Dec. 12. (See attached approval signatures: [T1034_orc_partial_20141212.pdf](#))

Future ORCs planned: We will be requesting an ORC for the filling of the cryo system, the operation of the bias & drift high voltage, and the TPC's optical detectors at a later date, when the cryosystem is ready to fill. Also on a future date we would like to complete checkout of the TPC and electronics which read out the TPC.

The apparatus and experimental area



Refer to the above drawing for the enumeration of apparatus and racks below.

The apparatus consists of:

None of the following: Flammable liquids, hazardous chemicals, radioactive sources, target materials, nuclear materials, lasers, cryogenics.

The apparatus does contain: Flammable gases, non-flammable gases, electronics, high voltage.

***** New apparatus added with this ORC: *****

Aerogel Cherenkov: (see documentation attached: [AerogelCherenkov.pdf](#))

- Two threshold Cherenkov detectors with solid aerogel medium, 2 PMTs each
- Two scintillator paddles as cosmic vetoes, 1 PMT each

COSMIC: These same parts were previously approved to operate while on a table in the enclosure, checked out and approved 2014 Dec. 12. The only change is that they have been mounted on tall stands of 80-20 extruded aluminum. (see documentation attached: [CosmicsReadout.pdf](#))

- Counters and PMTs: we have 16 counters with respective PMTs.
- The PMTs are Hamamatsu H5783 with input voltage ranging from 11.5 V to 15.5 V (not kV. These are *really* low voltage PMTs.)
- The counters are trapezoidal with dimensions 10" - 12" (base) X 24" (height) X around 1" (thickness).
- These counters were previously operated as part of CDF.

Muon Catcher:

- Welded, anodized & painted steel absorber assembly holding 16 scintillator paddles & PMTs with bases. These were rescued from KTeV.
- Device rests on concrete shielding blocks.
- PMTs and Bases are supported on foam pads by a Unistrut assembly anchored to the concrete support blocks.

In place but powered down, inoperational:

- Cryostat vessel – at atmosphere (separate safety review: Jay Theilacker)
- Cryo system for LAr filtration and through-passage (separate safety review: Jay Theilacker)
- TPC and readout electronics (see documentation attached: [TPCReadout.pdf](#))
- TPC drift & bias system (see documentation attached: [BiasAndDriftAndFeedthrough.pdf](#))

One new rack:

Cr: Cryogenic system (purity monitors, etc) – OFF. NOT TO BE OPERATED UNTIL CRYOSYSTEM REVIEW IS COMPLETE.

***** Previously Approved on 2014.12.12: *****

Five electronics racks in MC-7 enclosure:

F: FTB Facility rack

- MWPC controller
- Network switches

100: Cosmic Paddles & Logic

- 2 NIM crates with commercial NIM modules
- 1 D0-rescued MSU CCU prepared for LArIAT by PPD/EED/I&S

101: Scintillator Discriminators & Logic

- 2 NIM crates with commercial NIM modules

102: DAQ Computers

- FNAL Rack Protection System
- APC-brand Switch Rack PDU
- 1 NIM crate with commercial NIM modules, NIM fan module
- 1 CAMAC crate with 1 module
- 4 rack-mount Koi-brand computers managed by FEF-SWS

103: Waveform Digitization & Trigger

- 2 Wiener VME crates with commercial CAEN modules
- APC-brand Switch Rack PDU
- FNAL Rack Protection System

Material and Equipment in the beamline:

TOF detectors: These are provided by FTBF but have undergone characterization by T-1034 collaborators.

- **USTOF:** A scintillator counter read out by 4 PMTs. The area of the counter + PMTs is roughly 0.75x0.75m.
- **DSTOF:** A scintillator counter read out by 2 PMTs. The counter is roughly 15cm x 100 cm.
- Both counters were mounted on stands designed and assembled by FTBF staff.

VETO: This is a scintillator counter read out by 2PMTs. It has an area roughly 1.5x0.5m and is mounted on a stand designed and assembled by FTBF staff. It has a hole in the center, roughly the size of the cryostat's vacuum window.

PUNCH: These are 4 counters, each read out by a single PMT. The counters are large, roughly 0.3x2.0m, and will be mounted on a stand. They are used to select punch-through muons.

Wire chambers: These “Fenker” chambers and the stands they are mounted on are provided by FTBF. The chambers run with a **mix of 85% Ar and 15% Isobutane/Methane**. Bias voltage and readout electronics are also provided by FTBF and are mounted on the chambers. Readout controllers connect to the chambers via CAT-6 and sit in the F rack.

Dipoles: These dipole magnets and their power supplies are provided by the facility. Tagged by D. Jensen and J. Lentz.

COLL: This is an iron collimator 36” long with a 6” aperture. It is movable in and out of the beamline so that the Cherenkov detector can be inserted in its place. This isn't formally part of the ORC but is include in the drawing for completeness and context, as material near the beam.

Additionally:

Cabling: Cables run between the beamline counters and electronics racks via grounded cable trays which run above the secondary beam exclusion region. Where this was impractical, steel rope was strung, and cable bundles secured along it to minimize tension in the cables. We had help from FTBF staff to locate and install these trays and steel ropes.

Grounding straps: Each mechanical support in contact with equipment which can be powered is grounded to a common ground nearby.

Camera: We have two webcams which we'll use to monitor the apparatus, in addition to the ACNET and IFIX monitoring.

Summary of Hazards

- Flammable Ar/Isobutane/Methane gas for wire chambers
- High Voltage ($>50\text{V}$) for various counters